

PAST AND CURRENT ACTIONS IN MISSOURI

This strategy will build upon many years of successes in improving water quality through collaborative efforts among a broad array of partners in Missouri. As an example, Missouri has reduced soil loss by more than 170 million tons since the inception of the dedicated tax in 1984 that supports the Soil and Water Conservation Program, soil and water conservation districts and farmers in every county. Numerous communities have improved the performance of their wastewater treatment plants and are addressing combined sewer overflows (CSOs) in order to improve water quality. Many of the actions proposed in this strategy are expansions or continuations of efforts that have had measurable impacts on water quality in the past.

Wastewater Treatment

The City of Springfield Northwest Treatment Plant enhanced phosphorus and nitrogen removal through the installation of equipment and tanks which were completed in 2009. Springfield's Southwest Treatment Plant has implemented both biological and chemical phosphorus removal and biological nitrogen removal treatment processes. This plant is now meeting its 0.5 mg/L total phosphorus permit limit. Missouri adopted an effluent regulation that requires point source discharges to meet a 0.5 mg/L total phosphorus limit in the Lake Taneycomo and Table Rock Lake watersheds.

Combined Sewer and Sanitary Sewer Overflow Controls

Cities and sewer districts across the state have been actively working toward reducing combined sewer overflows and sanitary sewer overflows (SSOs) which may contribute nutrients and other pollutants to state waters.

- Kansas City initiated a pilot project to implement green infrastructure technologies to control wet weather flows throughout a 100-acre watershed served by the city's Publicly Owned Treatment Works (POTW). Green infrastructure may include rain gardens, permeable pavement, green roofs, and other BMPs. Kansas City will use the results of the pilot project to develop a plan for implementing green infrastructure projects across at least a 744-acre basin served by the City's POTW.
- The City of Independence is implementing a collection system and wastewater treatment plant remedial measures plan designed to eliminate capacity-related SSOs by April 2015. Projects completed in the Mill Creek watershed have significantly reduced capacity-related SSOs in that watershed.

Municipal Separate Storm Sewer Systems (MS4s) Education and Outreach

- Since 2003, the Mid-America Regional Council (MARC) has convened a committee of representatives from local governments and environmental organizations in the Kansas

City metropolitan area to develop a regional watershed public education program. For the past several years, the MARC public outreach campaign has targeted two topics: storm drain awareness and healthy lawn care. Messages include proper fertilizing methods, yard waste disposal, rain gardens, and landscaping with native plants. MARC conducts a biennial survey to measure impacts that water quality education efforts in the region are having on the public's awareness and behavior.

- The City of Columbia Show-Me Healthy Yards & Neighborhoods webpage offers environmentally responsible alternatives to traditional lawn care and household practices that contribute to the runoff of contaminants and excess nutrients.
- The City of Springfield has also implemented a Show-Me Yards & Neighborhoods program to encourage environmentally responsible alternatives to traditional lawn care and reduce excess nutrient runoff. Landscape professionals can become certified in this program.
- St. Louis County Stormwater Management Plan's co-permittees print and distribute brochures to residents and businesses on lawn care BMPs and provide annual training to municipalities on park maintenance and landscaping. The MSD Phase II program employees provide presentations about impacts of yard waste and improper lawn care chemicals at schools and other venues using the EnviroScape nonpoint source pollution model. MSD also supports programs like Show Me Rain Gardens and Bring Conservation Home to promote the benefits of rain gardens to reduce pollution.
- MDNR's Stormwater Information Clearinghouse. MDNR's online Stormwater Information Clearinghouse provides resources useful for MS4 permittee public education and outreach and other control measures to improve storm water runoff water quality.
- Missouri Guide to Green Infrastructure. MDNR published the Missouri Guide to Green Infrastructure in May 2012 to aid municipalities and developers in understanding how to incorporate green infrastructure into development and redevelopment projects to protect water quality.
- Storm Water Nutrient Monitoring. The three Phase I MS4 communities have been collecting storm water monitoring data, including nitrogen and phosphorus, in order to judge the effectiveness of their programs.
- City of Independence MS4 (HUC 10300101) Other Nutrient Reduction Actions
- The City of Independence enacted stream buffer and setback regulations in 2005 to preserve riparian corridors. (Other municipalities have also enacted stream setback ordinances.)
- Water quality improvement actions incorporated into the design of new regional storm water detention basins include seeding with native plants. The City has also retrofitted existing regional detention basins with native plants. Native vegetation is expected to improve water quality by filtering nutrients and reducing erosion and sedimentation into the receiving streams. The deeper root systems of trees, shrubs, native grasses and wildflowers encourage water infiltration, which reduces severity of downstream erosion.
- Several stream bank stabilization projects have been completed with native plantings installed. Projects that stabilize stream banks and establish a sustainable riparian corridor reduce sediment loadings and pollutants associated with storm water runoff.

The GENERATIONS Program

The GENERATIONS Program is an innovative Future Farmers of America (FFA)-farmer partnership supported by U.S. Environmental Protection Agency (EPA) Gulf of Mexico Program funds awarded to the Conservation Technology Information Center (CTIC). This program encouraged producers within the Little River Ditches Basin in five Bootheel counties (Dunklin, New Madrid, Pemiscot, Scott, and Stoddard), located in southeast Missouri to sign up for cornstalk sampling and nitrate testing. The University of Missouri Delta Research Center tested the cornstalk samples, free of charge to the producer, with financial assistance from the Conservation Technology Information Center. “End-of-season cornstalk testing” is a technique that can help corn producers ensure they apply enough nitrogen to reach harvest goals and improve the profitability of their farming operations, but not in quantities or at times when valuable fertilizer will likely wash away and impair downstream water quality. By assessing the levels of nitrate in cornstalks prior to harvest, producers can utilize this information as another fertilizer management tool in conjunction with soil maps, soil tests, yield maps, varietal differences, and different forms of nitrogen fertilizer to give more precision to next season’s fertilizer decisions. In addition, this test provides an important new tool for water quality stewardship.

Environmental Resources Coalition

The Environmental Resource Coalition (ERC) has engaged in the following projects that have contributed to nutrient reduction in Missouri.

- The Watershed Research Assessment and Stewardship Program (WRASP) – Stewardship Implementation Plan (SIP) was funded by the U.S. EPA, MDNR, Missouri Corn Growers Association/Missouri Merchandising Council (MCGA/MCMC), Syngenta, U.S. Department of Agriculture (USDA-ARS). Between 1999 and 2005 over \$5 million was spent to work with farmers to reduce Atrazine levels in several lake watersheds in Missouri. BMP’s were determined and education was provided to farmers. Through the use of 50 automated samplers installed in northern Missouri in streams and at the edge of fields to track seasonal runoff, this effort documented water quality benefits. Starting in 2004 and lasting until 2008, the project focus expanded to atrazine, nitrogen and phosphorus management practices and the environmental and economic impacts of their implementation. Field-scale trials were established in multiple locations within 303(d) listed watersheds. Sites were 40-60 acres in size and covered a total of more than 500 acres. The BMPs identified during WRASP were implemented. The ERC provided one-on-one assistance with landowners to implement BMPs that best fit their needs and used Integrated Crop Management (ICM) to increase profitability for farmers.
- A separate project entitled “Evaluating and Practicing Innovative Conservation (EPIC)” was funded by the U.S. Department of Agriculture (USDA-NRCS) Conservation Innovation Grant (CIG) and the Missouri Corn Growers Association/Missouri Merchandising Council (MCGA/MCMC) from 2010 until 2013. It helped construct edge-of-field denitrifying bioreactors and constructed wetlands. ERC planned to monitor runoff entering and leaving these structures to determine the effectiveness of the constructed structures for nutrient loss and reduction, but due adverse weather conditions that occurred during the project period, monitoring was never conducted.

Missouri Department of Natural Resources

Water Protection Program

- Numeric Water Quality Standards – Beginning in October 2005, the department convened a multi-sector advisory group tasked with developing numeric nutrient criteria for Missouri's waters. The advisory group met 19 times which led to the formation of a technical subcommittee that developed and proposed numeric nutrient criteria for lakes and reservoirs which became effective under state rules on October 30, 2009. However, in August 2011, EPA disapproved the general numeric nutrient criteria component of the rule [10 CSR 20-7.031(3)(N)] because its derivation and rationale "failed to demonstrate that the values or approaches to numeric nutrient criteria will protect the designated aquatic life or recreational uses." Conversely, the EPA did approve site-specific numeric nutrient criteria for lakes and reservoirs in Table M of the rule as these criteria "exhibit trophic characteristics that are fully supportive of aquatic life."
- Effluent Limitations for Point Source Discharges –As Missouri continues to implement its water quality standards for bacteria and toxics (e.g. ammonia), Publicly Owned Treatment Works (POTWs) and other facilities that discharge to waters of the state are in many instances required to achieve greater removal efficiencies of BOD and TSS in order to achieve reductions that comply with Missouri's Water Quality Standards. With these increases in removal efficiencies, there is often a secondary benefit of some nutrient removal. Similarly, many of these facilities have also made efforts to reduce inflow and infiltration in their wastewater collection systems in an effort to meet existing water quality-based and technology-based effluent limitations. In addition, metropolitan areas such as St. Joseph, Kansas City and St. Louis have consent judgments to reduce or eliminate untreated combined sewer overflows. Planned wastewater treatment plant upgrades at a major industrial facility that discharges directly to the Mississippi River, which in the past discharged significant volumes of TSS, BOD, and NH₃, will achieve reductions of TSS and BOD in the 90% range and NH₃ in the 50-75% range. The reduction of both ammonia toxicity and nutrient loading to the Mississippi River will have a quantifiable, positive impact on both local and downstream water quality.
- Section 319 Nonpoint Source Projects – Section 319(h) of the federal Clean Water Act provides the framework for states to support voluntary, watershed efforts to reduce nonpoint sources of pollution. Unlike point sources of pollution that can be attributed to a single discharge location, nonpoint sources of pollution are more diffuse in nature. Storm water runoff from agricultural lands, recreational areas and parking lots are all sources of nutrients for nonpoint source pollution. For the period of federal fiscal years 2003 – 2009, the department passed \$9,471,462 in 319(h) grants through to eligible project sponsors for the implementation of nutrient reduction best management practices. Implementation projects such as rain gardens, bioretention and infiltration basins, riparian buffers, native plant restoration, planned grazing and watering practices, wetland creation and nutrient management activities contributed to significant nutrient reductions in the state. The department estimates load reductions from these practices were in excess of 1,124,934 lbs/year of total nitrogen and 373,026 lbs/year of total phosphorous. In addition, development of 9-element watershed management plans is funded through watershed planning grants, and implementation of MDNR-approved watershed management plans is

funded through major subgrants that are used to install nonpoint source control practices and monitor water quality results. Minigrants are also available to address local nonpoint source water quality issues.

- The Missouri Volunteer Water Quality Monitoring Program provides training and equipment to citizen monitoring groups for sampling of physical, chemical, and biological data from monitoring sites throughout the state. Over 8,000 citizen volunteers have attended at least one of the training workshops. The program provides screening-level data used by state and local decision makers to determine current stream conditions and identify potential problems or trends in water quality. A similar program is supported for monitoring of the state's lakes and reservoirs (Lakes of Missouri Volunteer Program).
- Concentrated Animal Feeding Operations (CAFOs) are required to have nutrient management plans. Working in cooperation with the University of Missouri Extension, the Water Protection Program Permitting Section has assisted CAFOs develop plans that not only protect water quality from nutrients but provide a sustainable fertilizer for farm operations. In the past ten years, facilities have been required to treat for ammonia which in some cases reduces total nitrogen in the discharge. The Animal Waste Treatment Loan Program used to finance animal waste treatment systems for independent livestock and poultry producers at below conventional interest rates. The program is authorized for a total of \$10 million in revolving funds.
- The implementation of antidegradation procedures provides three levels of protection to prevent water quality degradation in waters of the state. The antidegradation reviews conducted for nutrient removal from point sources have led to greater protection of receiving waters. Several major cities (metropolitan areas within the Missouri and Mississippi River basins such as St. Joseph, Kansas City and St. Louis) with untreated combined sewer overflows now have approved long-term control plans that require a reduction in flow or the treatment of wet weather discharges.
- Sanitary sewer overflows and bypasses of secondary treatment at the wastewater treatment facility due to wet weather are expected to be less frequent because of NPDES permitting requirements to address these issues. During federal fiscal years 2003 – 2009, the department passed \$9,471,462 in 319(h) grants through to eligible project sponsors for the implementation of nutrient reduction best management practices. Implementation projects such as rain gardens, bioretention and infiltration basins, riparian buffers, native plant restoration, planned grazing and watering practices, wetland creation and nutrient management activities contributed to significant nutrient reductions in the state. The department estimates load reductions from these practices were in excess of 1,124,934 lbs/year of total nitrogen and 373,026 lbs/year of total phosphorous. Project type, total expenditures and estimated load reductions were derived from state and federal databases created to track 319 nonpoint source pollution control projects.
- Through our national Phase II Stormwater Rule the department now has land disturbance permitting for construction project \geq one (1) acre and small MS4 requirements for communities within the nine urbanized areas plus those communities of 10,000+ outside of urbanized areas. Many of the large- and medium-sized MS4 stormwater management plans that were permitted in after 2002 are implementing their BMPs. Below is a list of MS4 successes:

- Springfield, Kansas City and Independence have been monitoring stormwater quality since the early 2000s. The data is available upon request, but we do not have enough data to show trends related to policies or changes in management practices - due to latent policies and criteria, and a small number of monitoring locations overall.
- MS4s in the James River and Little Sac watersheds (Greene County area) have been monitoring to assess stormwater in response to TMDLs for about 5 years now, but again there is not enough information to date to show trends. (N&P in James River, bacteria in Little Sac)
- Other MS4s are not required to monitor as a general rule, but there will likely be an increase in monitoring effort with TMDL implementation plans.
- However, the requirement for 164 regulated Missouri MS4s is to implement a comprehensive program to reduce pollution from urban stormwater runoff. This includes required stormwater quality criteria for new and redevelopment projects. The requirement is to mimic pre-project runoff quality in new development (something like capture/"treat" the 90th percentile storm event on site – around 1" depending on location) and to make incremental improvements to redevelopment (this varies but some require 20% improvement while others apply the 90th percentile requirement to redevelopment also.) Such criteria are expected to address 75% urban runoff pollution concerns over time if implemented properly (per Pitt et al). The program also requires reductions/controls from active construction sites, municipal operations and illicit discharges.
- Regarding letter d. above, there is a trend toward accomplishing the development of related ordinances, criteria, policies and such.
- Water Quality Assessment and Total Maximum Daily Loads – Section 303(d) of the federal Clean Water Act provides the framework for states to assess the quality of their waters against approved water quality standards. Where technology-based controls are insufficient to ensure attainment of water quality standards, Total Maximum Daily Loads (TMDLs) are established to determine the maximum amount of a pollutant a water body can receive and still meet water quality standards. Missouri's 2012 303(d) List of impaired waters contains fifteen (15) water body/pollutant pairs that are listed as impaired for nutrients, based upon approved water quality standards. Table 1 below contains those waters currently assessed as impaired for nutrients.

Table 1. Missouri 2012 303(d) Listed waters impaired for nutrients.

<i>WBID</i>	<i>Water Body Name**</i>	<i>Class</i>	<i>Size</i>	<i>Units</i>	<i>Pollutant</i>
7003	Bowling Green (Old) Lake	L1	28.2*	Ac.	Nitrogen, Total
7003	Bowling Green (Old) Lake	L1	28.2*	Ac.	Phosphorus, Total

3239	Clear Cr.	C	3.5	Mi.	Nutrient/Eutrophication Biological Indicators
7151	Forest Lake	L1	573	Ac.	Chlorophyll-a
7151	Forest Lake	L1	573	Ac.	Nitrogen, Total
7151	Forest Lake	L1	573	Ac.	Phosphorus, Total
7008	Fox Valley Lake	L3	89	Ac.	Phosphorus, Total
7152	Hazel Creek Lake	L1	151	Ac.	Chlorophyll-a
7313	Table Rock Lake, James, Kings and Long Cr. Arms	L2	24507	Ac.	Nutrient/Eutrophication Biological Indicators
7313	Table Rock Lake, White River Arm	L2	17240	Ac.	Chlorophyll
7313	Table Rock Lake, White River Arm	L2	17240	Ac.	Nitrogen
7297	Terre Du Lac Lakes****	L3	103	Ac.	Chlorophyll-a
7297	Terre Du Lac Lakes****	L3	103	Ac.	Nitrogen, Total
7071	Weatherby Lake	L3	194	Ac.	Chlorophyll-a
7071	Weatherby Lake	L3	194	Ac.	Nitrogen, Total

- Since 1999, the department has developed twenty-one (21) TMDLs for water body-pollutant pairs listed as impaired for nutrients. Table 2 contains those waters that have either an approved or established TMDL or permit in lieu of TMDL (PIL). Implementation of these TMDLs is occurring through modification of Missouri State Operating Permits (MSOP) to incorporate nutrient effluent limitations, where necessary. Typically, wastewater treatment plant upgrades that address sludge handling and peak-flow bypasses resolve nutrient water quality issues. However, in certain situations effluent limitations for nutrients (total nitrogen, total phosphorous or both) are need to improve water quality. TMDL implementation is also occurring through installation of best management practices and education/outreach for the control of nonpoint sources of nutrients through the federal and state 319 grant program and Soil and Water Conservation District cost share program.

Table 2. Approved or established Missouri TMDLs or PILs for nutrients.

<i>WBID</i>	<i>Water Body</i>	<i>HUC 8</i>	<i>Type</i>	<i>Status</i>	<i>Pollutant</i>	<i>Approval</i>	<i>Agency</i>
3250	Big Sugar Cr.	11070208	TMDL	APPROVED	Nutrients	3/26/2004	MoDNR
3269	Buffalo Cr.	11070208	TMDL	APPROVED	Nutrients	3/26/2004	MoDNR
3273	Buffalo Cr.	11070208	TMDL	APPROVED	Nutrients	3/26/2004	MoDNR
3245U-01	Cave Springs Br.	11070206	TMDL	APPROVED	Nutrients	12/6/2010	MoDNR
912	Davis Cr.	10300104	TMDL	APPROVED	Nutrients	8/13/2003	MoDNR
811	E. Brush Cr.	10300102	PIL	APPROVED	Nutrients	12/11/2006	MoDNR
3246	Elk R.	11070208	TMDL	APPROVED	Nutrients	3/26/2004	MoDNR
3256	Indian Cr.	11070208	TMDL	APPROVED	Nutrients	3/26/2004	MoDNR
2347	James R.	11010002	TMDL	APPROVED	Nutrients	5/7/2001	MoDNR
2362	James R.	11010002	TMDL	APPROVED	Nutrients	5/7/2001	MoDNR
2365	James R.	11010002	TMDL	APPROVED	Nutrients	5/7/2001	MoDNR
3249	L. Sugar Cr.	11070208	TMDL	APPROVED	Nutrients	3/26/2004	MoDNR
7356	Lamar Lake	11070207	TMDL	APPROVED	Nutrients	7/20/2006	MoDNR
3262	M. Indian Cr.	11070208	TMDL	APPROVED	Nutrients	3/26/2004	MoDNR
3263	M. Indian Cr.	11070208	TMDL	APPROVED	Nutrients	3/26/2004	MoDNR
7236	McDaniel Lake	10290106	TMDL	APPROVED	Algae	2/3/2004	MoDNR
3260	N. Indian Cr.	11070208	TMDL	APPROVED	Nutrients	3/26/2004	MoDNR
3268	Patterson Cr.	11070208	TMDL	APPROVED	Nutrients	3/26/2004	MoDNR
3259	S. Indian Cr.	11070208	TMDL	APPROVED	Nutrients	3/26/2004	MoDNR

7187	Spring Fork Lake	10300103	TMDL	APPROVED	Nutrients	7/20/2006	MoDNR
2755	W. Fk. Black R.	11010007	TMDL	ESTABLISHED	Nutrients	12/23/2010	EPA

Soil and Water Conservation Program

The Soil and Water Conservation Program provides financial incentives to landowners to implement agricultural conservation practices that help prevent soil erosion and protect water resources. By promoting good farming techniques that help keep soil on the fields and waters clean, the program helps conserve the productivity of Missouri's agricultural lands. The SWCP works with the state's 114 county-level soil and water conservation districts to accomplish these goals. Based on the districts' needs assessments, which evaluate resource concerns locally, an annual cost-share allocation is provided to each district to help address those conservation concerns. Within the SWCP, there are a number of initiatives, programs, and projects that focus on nutrient reductions. For erosion control practices approved by each county's Soil and Water District, the land upon which the practice is to be implemented must be eroding at rates greater than tolerable soil loss or "T" or experiencing active gully erosion. The Soil and Water Conservation Program (SWCP) is funded by the one-tenth-of-one-percent parks, soils and water sales tax, which the Soil and Water Conservation Program shares with the Division of State Parks (Merle Doughty, 1992).

- The Missouri Soil and Water Conservation Cost-Share Program annually expends \$25-27 million in cost-share payments to producers and implements 6,000 or more conservation practices. Program funds are available to landowners to provide an incentive payment of up to 75 percent of the cost of applying soil conservation practices to the land. Since 1982, Missouri has reduced its rate of soil erosion on cropland more than any other state, based on data from United States Department of Agriculture - Natural Resources Conservation Service. Missouri once was the second worst state in the nation based on its rate of soil erosion. Much of this success can be attributed to the dedicated sales tax that funds the voluntary soil and water conservation programs. Since the initial passage of Missouri's parks, soils and water sales tax in 1984, the Department of Natural Resources has provided over \$475 million to Missouri agricultural landowners to protect the state's soil and water resources. With the department's help, Missouri agricultural landowners have saved in excess of 170 million tons of soil from going into our lakes and streams since 1984. This has led to a concomitant reduction in the loss of phosphorus to streams and lakes.
- With passage of Missouri House Bill 250 in 2009, the SWCP was authorized to expand its soil and water conservation practices to specifically address water quality issues on a statewide basis. This action allows the program to protect and improve additional water quality issues relating to agricultural land. In addition to soil erosion efforts, the program is now also able to help many more landowners voluntarily address resource concerns such as nutrient and pest management, irrigation management, pasture management, buffers, woodland erosion, and animal waste management practices. This change has resulted in greater landowner participation across the state.

- Needs Assessments - Soil and water conservation efforts are locally-led by district boards, which play an important role in determining the resource concerns of each district through a needs assessment process. A needs assessment framework was enacted in 2008, and requires each of the 114 soil and water conservation districts (districts) to develop an annual needs assessment of their resource concerns and cost-share funding needs for the next fiscal cycle. Resource concerns are problem areas within a farm that are eroding above tolerable soil loss, have active gully erosion, or are impacting soil and water resources. Annual needs assessments are developed by each of the 114 soil and water conservation districts (districts) in the state and their input assists the commission in determining district cost-share allocations for the implementation of conservation practices. Currently, a total of 49 practices are available to districts. Typically, the annual demand for cost-share (\$70 million) has far exceeded the available cost-share funds (\$25 million).
- Targeted Watershed Program - The Targeted Watershed Program focuses on reducing agricultural nonpoint source pollution in high priority watersheds across the state. The goal of this program is to encourage landowners to voluntarily implement best management practices that will improve water quality. In 2009, this program was initially funded with a \$177,249 allocation for three watersheds: Jack's Fork, North Fork Spring River, and Black Creek. Jack's Fork and North Fork Spring River are currently on Missouri's Section 303(d) list of impaired waters. The program currently provides cost-share funds in only the North Fork Spring River and Black Creek watersheds.
- Since 2010, Missouri has been able to use funds from the Parks, Soils, and Water Sales Tax as nonfederal match in successful applications for 29 projects and \$51.6 million dollars in additional federal cost-share funds through the Mississippi River Basin Healthy Watersheds Initiative (MRBI) and Cooperative Conservation Partnership Initiative (CCPI) programs of the U.S Department of Agricultural - Natural Resources Conservation Service. The SWCP program staff developed proposals for federal funding to provide additional cost-share funds for implementing conservation practices in targeted watersheds or to develop innovative conservation practices or tools. Three Missouri project proposals were awarded Cooperative Conservation Partnership Initiative (CCPI) funding in 2010 and will receive a total of up to \$2.52 million over 5 years. Four Missouri project proposals were awarded CCPI funding in 2011 and will receive up to \$3.33 million over five years. In addition, \$345,000 in federal Farm Bill funding was received in 2011 to implement Strategic Watershed Action Teams (SWATs) through a partnership contribution agreement with the State of Missouri which will provide additional "boots on the ground" to help implement the Mississippi River Basin Healthy Watersheds Initiative (MRBI) conservation practices and accelerate implementation of Missouri's MRBI projects.
- U.S. EPA Region 7 Partners with MDNR for MRBI Projects - The U.S. Environmental Protection Agency Region 7 (Region 7) is partnering with the Missouri Department of Natural Resources (MDNR) to provide monitoring support for Missouri's Mississippi River Basin Healthy Watersheds Initiative (MRBI) projects. At the request of MDNR, Region 7 is identifying, selecting, and monitoring wadeable reference streams in the Lower Grand watershed, which contains six of Missouri's 12 MRBI projects that were awarded funding in 2010. Region 7's monitoring team and Geographic Information Systems (GIS) group are collaborating with MDNR's monitoring program in the

identification of reference watershed candidates and in the eventual selection of wadeable stream reference sites. Once identified, the Region 7 monitoring team will monitor three new reference sites for biological, chemical, and physical constituents including fish and macroinvertebrate community sampling and identification; algal sampling and taxonomic identification; in-stream and near-stream habitat assessments; watershed condition assessments; and water and sediment chemistry sampling and analysis. Field work is scheduled to begin during the summer of 2011 and continue through the fall of 2011 and the spring of 2012. An estimated \$67,200 in services-in-kind will be contributed by Region 7 in support of Missouri's MRBI projects in the Lower Grand watershed.

- **Missouri Nutrient Tracking Tool** – In December 2011, the department entered into a contract with the Texas Institute for Applied Environmental Research (TIAER) of Tarleton State University to conduct a pilot project that will apply and enhance the Nutrient Tracking Tool (NTT) model in three 8-digit Hydrologic Unit Code (HUC) watersheds (Spring River, North Fork Salt, and South Fork Salt) in Missouri as a field-level conservation practice assessment tool. In order to produce realistic estimates of nonpoint source pollutant loss reductions using NTT, watershed-specific edge-of-field monitoring and farm management data will be used to validate and calibrate the model. The department will use NTT to help evaluate the effectiveness of farm conservation practices implemented through the Missouri Soil and Water Conservation Cost-Share Program in reducing sediment, nitrogen, phosphorus, and carbon losses from individual farm fields and in documenting the statewide success of the 1/10th of 1 percent Parks, Soil, and Water Sales Tax.

U.S. Department of Agriculture - Natural Resources Conservation Service

Importance of Missouri Private Lands in Gulf Hypoxia Efforts

Missouri lays at the nation's crossroads for water confluences with the Missouri River, Ohio River, and Mississippi River all intersecting the state's borders. The Missouri and Mississippi rivers shape more than 1,000 miles of the state's borders and serve as major drainage ways to the Gulf of Mexico. Missouri is a large and diverse agricultural state, with significant grain and livestock production. Various studies list agriculture as one of the leading contributors of sediment and nutrient loading to the Gulf of Mexico. While this is unfortunate, it is not particularly surprising when one considers the land use requirements needed to supply the demand for food production. To that end, the private land owners of the state are an important resource to significantly enhance both local and national waters.

Federal Voluntary Approach to Sound Stewardship

Missouri NRCS, through its national framework, works extensively with private landowners, especially farmers and ranchers, to implement wise use of natural resources. To accomplish this goal, the NRCS focuses on the voluntary implementation of conservation practices that take a systems approach to addressing environmental issues. Research has shown that conservation practices, especially when installed as a system; make positive contributions to water quality through sediment, nutrient, and agricultural chemical reductions in both runoff and drainage waters. The objective is to maintain a productive land that is environmentally sustainable.

Missouri NRCS cooperates with state and local entities to set priorities and allocate technical and financial assistance through federal conservation programs. Perhaps the most essential program

administered by NRCS is the Conservation Technical Assistance Program. This federal assistance basically allows the NRCS to extend technical advice to private landowners free of charge and without the obligation to participate in financial assistance programs. Providing technical advice to land managers places them in the best position to make well informed decisions regarding conservation.

Reviewing the Last Decade of Progress

For over 70 years, landowners in Missouri have received federal assistance to protect soil, water, air, plants, and animals. The federal investments made through the NRCS under working lands programs (Table 1) and conservation easements (Table 2) over the last decade are substantial. These federal assistance funds have also been leveraged by funds contributed by participants as part of program requirements. Because all planning procedures must have a positive planning effect on the resource concerns present, the end result of the contracting activities is an improved functioning ecosystem. Considering that many of the conservation practices have multi-year life spans, these conservation investments will yield environmental benefits for the nation for many years.

Table 1. NRCS Federal Investments Made on Missouri Working Lands to Combat Non-Point Source Issues					
Source: USDA REAP Division Contract Years 2002-2012					
4 Digit Sub-region Watershed	Contract Count	Acres Under Contract	Financial Obligations for Conservation	Financial Payments for Conservation	Conservation Technical Assistance
0710 – Des Moines River Basin	14	2,042	\$ 441,923	\$ 346,909	
0711 – Upper Mississippi River - Salt	2,014	480,043	\$ 41,132,496	\$ 29,627,006	
0714 – Upper Mississippi River - Meramac	1,061	190,037	\$ 12,743,475	\$ 9,282,457	
0801 – Lower Mississippi River - Hatchie	10	7,727	\$ 484,256	\$ 306,469	
0802 – Lower Mississippi River – St. Francis	2,830	983,444	\$ 186,624,579	\$ 172,939,987	
1024 – Missouri River – Nishnabotna	1,355	271,441	\$ 18,458,179	\$ 14,242,955	
1028 – Chariton-Grand Rivers	1,652	295,816	\$ 33,403,654	\$ 19,522,684	
1029 – Gasconade – Osage Rivers	2,312	426,577	\$ 34,595,589	\$ 24,817,064	
1030 – Lower Missouri	2,623	471,369	\$ 41,044,048	\$ 33,785,455	
1101 – Upper White River	1,615	445,493	\$ 26,753,606	\$ 19,009,821	
1107 – Neosho – Verdigris Rivers	946	227,749	\$ 29,130,936	\$ 27,232,706	
Totals	16,432	3,801,738	\$ 424,812,742	\$351,113,514	

Table 2. NRCS Federal Investments Made Through Conservation Easements within Missouri									
Source: USDA REAP Division Contract Years 2002-2012									
4 Digit Sub-region Watershed Basis				County Basis					
	Wetland Reserve Program			Grassland Reserve Program		Emergency Watershed Protection Program		Farm and Ranch Lands Protection Program	
	Easements	Acres		Easements	Acres	Easements	Acres	Easements	Acres
0710 – Des Moines River Basin	----	----	Adair	3	422				
0711 – Upper Mississippi River - Salt	78	8,045	Barton	3	212				
0714 – Upper Mississippi River - Meramac	15	2,266	Bates	2	409				
0801 – Lower Mississippi River - Hatchie	17	9,714	Benton	3	492				
0802 – Lower Mississippi River – St. Francis	68	9,673	Cedar	3	288				
1024 – Missouri River – Nishnabotna	23	2,006	Christian					1	70

1028 – Chariton-Grand Rivers	133	15,893	Dade	1	159				
1029 – Gasconade – Osage Rivers	31	3,560	Chariton			1	47		
1030 – Lower Missouri	85	7,374	Dunklin			1	207		
1101 – Upper White River	7	363	Lawrence	3	479				
1107 – Neosho – Verdigris Rivers	9	440	Linn			3	1501		
			Livingston			1	146		
			Mississippi			3	153		
			Pettis	3	134				
			Pemiscot			3	241		
			Pike			1	226		
			Polk	1	38				
			St. Clair	4	457				
			Sullivan	2	169				
			Vernon	8	923				
Totals	470	59,334	Totals	36	4,182	13	2,521	1	70

Targeting Conservation for Better Efficiency

As advancements in science have been made available, conservation professionals are gaining a better understanding of the importance of targeting efforts. Not all lands contribute equally to sediment and nutrient loading of streams and lakes. Identifying vulnerable areas on the land provides the greatest opportunity to reduce pollution effects. Each year, requests for federal funds exceed allocations made by the Secretary of Agriculture. Historically, NRCS ranking and screening protocols strive to select applications that will make significant environmental enhancements to land in the fairest possible manner.

In addition to general operating procedures, the Missouri NRCS participates in two national landscape initiatives that further target conservation activities in priority watersheds. In Missouri, the NRCS State Conservationist authorized the Lower Grand, North and South Fork Salt, Lower St. Francis, Little River Ditches, and Cache River 8-digit watersheds eligible to participate in the Mississippi River Basin Healthy Watersheds Initiative (MRBI). Projects from local sponsors within these 8-digit focus areas were solicited to address watershed concerns. Since 2010, 22 active MRBI Projects have been developed to utilize a systems approach by selecting core and supporting practices that avoid, control, and trap nutrients. Projects are on-going, but from 2010-2012 Missouri NRCS entered into 874 voluntary contracts with private landowners on 80,726 acres of land through the MRBI.

In 2012, the NRCS created the National Water Quality Initiative (NWQI), a national initiative that works in priority watersheds to help farmers, ranchers and forest landowners improve water quality and aquatic habitats in impaired streams. In consultation with local and state entities, Missouri NRCS now offers additional assistance to help producers implement conservation and management practices in smaller, 12 digit watersheds in the North Fork of the Spring River, Little Medicine Creek, and Troublesome Creek. The federal efforts are leveraged with other local and state partners to magnify efforts. Together, MRBI and NWQI accelerate funding for land treatment over and above existing NRCS efforts.

Future Efforts by the NRCS

Although national priorities are set by the Secretary of Agriculture and may vary according to the administrative governance in place, the protection of soil and water are paramount for the agency. All NRCS programs and operations are subject to congressional authorization through

the federal budgeting process, primarily through the “Farm Bill”. These activities undergo periodic revisions and are subject to the prevailing political climate. Even so, most elected officials recognize how important conservation investments are to benefit the nation’s resources and productivity. Although the administration and funding levels may fluctuate from year to year, it is anticipated that future conservation programs will remain available to the public in some form.

U.S. Geological Survey (USGS)

Attached is a list of the current USGS gage stations within the Ambient Stream Water Quality Monitoring Network (**Appendix ?**). Water quality samples are collected at each of these stations and analyzed for major ions, nutrients, and trace metals. These stations are sampled between 6-12 times per year. A map of the network is shown in Figure ?. The USGS and the Missouri Department of Natural Resources (MDNR) entered into a joint funding agreement to monitor various streams, springs, and rivers throughout the state. The objective of the network is to maintain a baseline of water quality monitoring data for state resource planning activities. The network began in 1969 with 18 stations. By 1979, MDNR’s Division of Environmental Quality (DEQ) was responsible for maintaining the network and began a joint funding agreement with USGS to monitor 20 stations. This cooperative effort continued until it reached a peak of 41 stations in 1986. By 1991, the network was reduced to 5 stations. Then in 1993, the MDNR began to re-establish stations that were discontinued in the late 1980’s. The network was increased to 22 stations and continued to grow to 39 stations in 1994. The number of stations in the network remained relatively stable from 1994 through 1999. Approximately 25 new stations were added in 2000. Currently, there are 73 stations in the network.



Figure 7. U.S. Geological Survey/Missouri Department of Natural Resources Ambient Stream Water Quality Monitoring Network.